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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/623,900	07/21/2003	Jerry R. Kukulka	PD 02-1013 (21797-0004)	7639

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EXAMINER	
FICK, ANTHONY D	
ART UNIT	PAPER NUMBER
1753	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/623,900	KUKULKA ET AL.	
	Examiner	Art Unit	
	Anthony Fick	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Remarks

1. Applicant's amendment to claim 16 has overcome the previous objection. Applicant's arguments regarding the Morita, Studer et al. and Chang references are deemed persuasive. The rejections under 35 U.S.C. 103(a) regarding those references have been withdrawn.

Claim Objections

2. Claim 15 is objected to because of the following informalities: although the claim is marked as "Original", there is a typo in the claim that is not in the original. In line 3, palladium is spelled as "pal1adium". Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Lindmayer (U.S. 4,124,455).

Lindmayer discloses a method of making solar cells with multiple-metal contacts.

Regarding claim 1, Lindmayer discloses a solar cell comprising an active semiconductor structure, a back electrical contact and a front electrical contact (column 1, paragraph 3). Lindmayer further discloses the front contact has multiple layers comprising a titanium layer contacting the solar cell, a layer overlying the titanium layer

of titanium group metal mixed with platinum group metal, a third layer of platinum group metal, and a silver layer overlying the platinum group metal layer (column 3, paragraph 1). As the present specification states that platinum and palladium are barrier-layer metals and silver is a joining layer metal, the third and fourth layers of Lindmayer are deemed a barrier layer and a joining layer. Further, the metals contained in the second layer will diffuse into neighboring layers and thus it is the position of the examiner that this layer can be considered a diffusion layer.

Regarding claims 2, 3 and 4, Lindmayer discloses the use of current collecting busbars or other suitable means for directing electrons away from the cell (column 1, paragraph 3). A front electrical lead attached to the busbar or an attachment pad is necessary to extract any electricity from the cell and thus would inherently be present.

Regarding claims 6 and 7, Lindmayer teaches the use of platinum or palladium as the barrier layer (column 2, paragraph 1) and silver or copper as the joining layer (column 4, paragraph 2).

Regarding claim 9, Lindmayer discloses the solar cell is a silicon solar cell (column 3, paragraph 2).

Regarding claims 10 and 11, Lindmayer discloses method of making a solar cell comprising an active semiconductor structure, a back electrical contact and a front electrical contact (column 1, paragraph 3). Lindmayer further discloses the front contact has multiple layers, sequentially deposited (column 3, paragraph 2), comprising a titanium layer contacting the solar cell, a layer overlying the titanium layer of titanium group metal mixed with platinum group metal, a third layer of platinum group metal, and

a silver layer overlying the platinum group metal layer (column 3, paragraph 1). As the present specification states that platinum and palladium are barrier-layer metals and silver is a joining layer metal, the third and fourth layers of Lindmayer are deemed a barrier layer and a joining layer. Further, the metals contained in the second layer will diffuse into neighboring layers and thus it is the position of the examiner that this layer can be considered a diffusion layer.

Regarding claim 13, Lindmayer discloses the use of current collecting busbars or other suitable means for directing electrons away from the cell (column 1, paragraph 3). A front electrical lead attached to the busbar or an attachment pad is necessary to extract any electricity from the cell and thus would inherently be present.

Regarding claim 15, Lindmayer teaches the use of platinum or palladium as the barrier layer (column 2, paragraph 1).

Regarding claim 16, Lindmayer discloses the solar cell is a silicon solar cell (column 3, paragraph 2).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 8, 14, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lindmayer (U.S. 4,124,455).

Lindmayer discloses a method of making solar cells with multiple-metal contacts. Lindmayer discloses a solar cell and method of making a solar cell, comprising an active semiconductor structure, a back electrical contact and a front electrical contact (column 1, paragraph 3). Lindmayer further discloses the front contact has multiple layers comprising a titanium layer contacting the solar cell, a layer overlying the titanium layer of titanium group metal mixed with platinum group metal, a third layer of platinum group metal, and a silver layer overlying the platinum group metal layer (column 3, paragraph 1). As the present specification states that platinum and palladium are barrier-layer metals and silver is a joining layer metal, the third and fourth layers of Lindmayer are deemed a barrier layer and a joining layer. Further, the metals contained in the second layer will diffuse into neighboring layers and thus it is the position of the examiner that this layer can be considered a diffusion layer. Lindmayer discloses the thickness of the titanium layer is 500 angstroms, the diffusion layer is 700 angstroms, the barrier layer is 500 angstroms and the joining layer is 60,000 angstroms (column 3, paragraph 2 and column 4, paragraph 1).

The difference between Lindmayer and the claims is the requirement of a thinner titanium and diffusion layer.

The choice of a specific layer thickness is dependent on the specific application and absent any unexpected results, it would be obvious to choose layer thicknesses within the ranges of the present claims for the electrode of Lindmayer. Thinner layers utilize less material and thus can improve the cost of the device.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lindmayer as applied to claims 1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 15 and 16 above, and further in view of Yin et al. (U.S. 5,103,268).

The disclosure of Lindmayer is as stated above for claims 1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 15 and 16.

The difference between Lindmayer and claim 5 is the requirement of the diffusion layer to be made of gold.

Yin teaches an interfacial electrode layer for semiconductor devices shown in figures 2A, 2B and 2C. The interfacial electrode comprises layers of metals including an ultrathin layer of titanium attached to the semiconductor, with a thicker layer of a fixable metal such as gold overlying the thin layer of titanium.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize a gold layer over the titanium layer as in Yin with the multi-layer electrode of Lindmayer because the combination of the layers produces high resistance regions adjacent any pinhole-type defects of the active semiconductor layer and form reliable electrical contacts (Yin column 3, paragraph 3). Because Yin and Lindmayer are concerned with multi-layer electrodes on semiconductors, one would have a reasonable expectation of success from the combination. Thus the combination meets the claim.

8. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lindmayer as applied to claims 1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 15 and 16 above, and further in view of Morita et al. (U.S. 4,468,853).

The disclosure of Lindmayer is as stated above for claims 1, 2, 3, 4, 6, 7, 9, 10, 11, 13, 15 and 16.

The difference between Lindmayer and claim 12 is the requirement of sequential vacuum deposition of all the metal layers of the electrode.

Morita teaches a solar cell manufacturing method. Morita teaches a front electrical contact of multiple layers including titanium, a barrier layer of palladium, and a joining layer of silver (figure 4 and column 4, first paragraph). Morita teaches sequential vacuum deposition of the layers (column 4, paragraph 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the sequential vacuum deposition of all the layers of the electrode as in Morita within the method of Lindmayer because the sequential vacuum deposition produces a solar cell that can be made at low cost because of simpler manufacturing apparatus and reduced labor time (Morita column 4, paragraph 2). Because Morita and Lindmayer are concerned with solar cells, one would have a reasonable expectation of success from the combination. Thus the combination meets the claim.

9. Claims 17 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lindmayer (U.S. 4,124,455) in view of Yin et al. (U.S. 5,103,268) and Morita et al. (U.S. 4,468,853).

Lindmayer discloses a method of making solar cells with multiple-metal contacts. The solar cell comprises an active semiconductor structure, a back electrical contact and a front electrical contact (column 1, paragraph 3). Lindmayer further discloses the

front contact has multiple layers comprising a titanium layer contacting the solar cell, a layer overlying the titanium layer of titanium group metal mixed with platinum group metal, a third layer of platinum, and a silver layer overlying the platinum layer (column 3, paragraph 1). Lindmayer discloses the thickness of the titanium layer is 500 angstroms, the diffusion layer is 700 angstroms, the platinum layer is 500 angstroms and the silver layer is 60,000 angstroms (column 3, paragraph 2 and column 4, paragraph 1). Lindmayer discloses the use of current collecting busbars or other suitable means for directing electrons away from the cell (column 1, paragraph 3). A front electrical lead attached to the busbar or an attachment pad is necessary to extract any electricity from the cell and thus would inherently be present.

The differences between Lindmayer and the claims are the requirement of a gold layer between the titanium and platinum layers, sequentially vacuum depositing the layers and the thickness of the titanium layer.

Yin teaches an interfacial electrode layer for semiconductor devices shown in figures 2A, 2B and 2C. The interfacial electrode comprises layers of metals including an ultrathin layer of titanium attached to the semiconductor, with a thicker layer of a fixable metal such as gold overlying the thin layer of titanium.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize a gold layer over the titanium layer as in Yin with the multi-layer electrode of Lindmayer because the combination of the layers produces high resistance regions adjacent any pinhole-type defects of the active semiconductor layer and form reliable electrical contacts (Yin column 3, paragraph 3). Because Yin and

Lindmayer are concerned with multi-layer electrodes on semiconductors, one would have a reasonable expectation of success from the combination.

Morita teaches a solar cell manufacturing method. Morita teaches a front electrical contact of multiple layers including titanium, a barrier layer of palladium, and a joining layer of silver (figure 4 and column 4, first paragraph). Morita teaches sequential vacuum deposition of the layers (column 4, paragraph 1).

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to utilize the sequential vacuum deposition of all the layers of the electrode as in Morita within the method of Lindmayer in view of Yin because the sequential vacuum deposition produces a solar cell that can be made at low cost because of simpler manufacturing apparatus and reduced labor time (Morita column 4, paragraph 2). Because Morita, Yin and Lindmayer are concerned with semiconductor devices, one would have a reasonable expectation of success from the combination. Thus the combination meets claim 17.

Regarding claim 20, the choice of a specific layer thickness is dependent on the specific application and absent any unexpected results, it would be obvious to choose layer thicknesses within the range of claim 20 for the electrode of Lindmayer in view of Yin and Morita. Thinner layers utilize less material and thus can improve the cost of the device.

Response to Arguments

10. Applicant's arguments with respect to claims 1-17 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anthony Fick whose telephone number is (571) 272-6393. The examiner can normally be reached on Monday thru Friday 7 AM to 4 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Anthony Fick ADF
AU 1753
March 17, 2007

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